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Patent
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SPEECH CODING SYSTEM WITH TIME-DOMAIN NOISE ATTENUATION

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BACKGROUND OF THE INVENTION

1. Cross Reference to Related Applications

The following co-pending and commonly assigned U.S. patent applications have been filed on the same day as this application. All of these applications relate to and further describe other aspects of the embodiments disclosed in this application and are incorporated by reference in their entirety.

United States Patent Application Serial Number 09/663,242, "SELECTABLE MODE VOCODER SYSTEM," Attorney Reference Number: 98RSS365CIP (10508/4), filed on September 15, 2000, and is now United States Patent Number 6556996.

United States Patent Application Serial Number 60/233,043, "INJECTING HIGH FREQUENCY NOISE INTO PULSE EXCITATION FOR LOW BIT RATE CELP," Attorney Reference Number: 00CXT0065D (10508/5), filed on September 15, 2000, ~~and is now United States Patent Number _____~~.

United States Patent Application Serial Number 60/232,939, "SHORT TERM ENHANCEMENT IN CELP SPEECH CODING," Attorney Reference Number: 00CXT0666N (10508/6), filed on September 15, 2000, ~~and is now United States Patent Number _____~~.

United States Patent Application Serial Number 60/233,045, "SYSTEM OF DYNAMIC PULSE POSITION TRACKS FOR PULSE-LIKE EXCITATION IN SPEECH CODING," Attorney Reference Number: 00CXT0573N (10508/7), filed on September 15, 2000, ~~and is now United States Patent Number _____~~.

United States Patent Application Serial Number 60/233,042, "SYSTEM FOR AN ADAPTIVE EXCITATION PATTERN FOR SPEECH CODING," Attorney Reference Number: 98RSS366 (10508/9), filed on September 15, 2000, ~~and is now United States Patent Number _____~~.

United States Patent Application Serial Number 60/233,046, "SYSTEM FOR ENCODING SPEECH INFORMATION USING AN ADAPTIVE CODEBOOK WITH DIFFERENT RESOLUTION LEVELS," Attorney Reference Number: 00CXT0670N (10508/13), filed on September 15, 2000, ~~and is now United States Patent Number _____~~.

United States Patent Application Serial Number 09/663,837, "CODEBOOK TABLES FOR ENCODING AND DECODING," Attorney Reference Number: 00CXT0669N (10508/14), filed on September 15, 2000, and is now United States Patent Number 6574593.

United States Patent Application Serial Number 09/662,828, "BIT STREAM PROTOCOL FOR TRANSMISSION OF ENCODED VOICE SIGNALS," Attorney Reference Number: 00CXT0668N (10508/15), filed on September 15, 2000, and is now United States Patent Number 6581032.

United States Patent Application Serial Number 60/233,044, "SYSTEM FOR FILTERING SPECTRAL CONTENT OF A SIGNAL FOR SPEECH ENCODING," Attorney Reference Number: 00CXT0667N (10508/16), ~~filed on September 15, 2000, and is now United States Patent Number _____~~.

United States Patent Application Serial Number 09/663,734, "SYSTEM OF ENCODING AND DECODING SPEECH SIGNALS," Attorney Reference Number: 00CXT0665N (10508/17), filed on September 15, 2000, and is now United States Patent Number 6604070.

United States Patent Application Serial Number 09/663,002, "SYSTEM FOR SPEECH ENCODING HAVING AN ADAPTIVE FRAME ARRANGEMENT," Attorney Reference Number: 98RSS384CIP (10508/18), filed on September 15, ~~2000, and is now United States Patent Number _____~~.

United States Patent Application Serial Number 60/232,938, "SYSTEM FOR IMPROVED USE OF SUBCODEBOOKS," Attorney Reference Number:

00CXT0569N (10508/19), filed on September 15, 2000, ~~and is now United States Patent Number _____~~.

2. Technical Field

This invention relates generally to digital coding systems. More particularly, this invention relates to digital speech coding systems having noise suppression.

3. Related Art

Telecommunication systems include both landline and wireless radio systems. Wireless telecommunication systems use radio frequency (RF) communication. Currently, the frequencies available for wireless systems are centered in frequency ranges around 900 MHz and 1900 MHz. The expanding popularity of wireless communication devices, such as cellular telephones is increasing the RF traffic in these frequency ranges. Reduced bandwidth communication would permit more data and voice transmissions in these frequency ranges, enabling the wireless system to allocate resources to a larger number of users.

Wireless systems may transmit digital or analog data. Digital transmission, however, has greater noise immunity and reliability than analog transmission. Digital transmission also provides more compact equipment and the ability to implement sophisticated signal processing functions. In the digital transmission of speech signals, an analog-to-digital converter samples an analog speech waveform. The digitally converted waveform is compressed (encoded) for transmission. The encoded signal is received and decompressed (decoded). After digital-to-analog conversion, the reconstructed speech is played in an earpiece, loudspeaker, or the like.

The analog-to-digital converter uses a large number of bits to represent the analog speech waveform. This larger number of bits creates a relatively large bandwidth. Speech compression reduces the number of bits that represent the speech signal, thus reducing the bandwidth needed for transmission. However, speech compression may result in degradation of the quality of decompressed speech. In general, a higher bit rate results in a higher quality, while a lower bit rate results in a lower quality.